Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

1.932
A2Ag8
no. 129

O.P. No. 3338

ACE-129

UNITED STATES DEPARTMENT OF AGRICULTURE
Bureau of Agricultural Chemistry and Engineering
and
Agricultural Marketing Service

April 1941 Stoneville, Mississippi

# COTTON GINNING RESEARCH AND EXTENSION ACTIVITIES IN 1940

LIBRARY
RECEIVED
★ DEC 10 1941 ★
U. S. Department of Agriculture

By
Charles A. Bennett, Senior Mechanical Engineer
Bureau of Agricultural Chemistry and Engineering
and
Francis L. Gerdes, Senior Cotton Technologist
Agricultural Marketing Service.

The ginning research of the U. S. Department of Agriculture produced many interesting developments in 1940 which received widespread application in the field through the ginning extension programs of the State Agricultural Extension Services. Cotton producers and ginners showed a live interest in this work designed to provide means for improving the quality and value of the producers' cotton.

The cotton ginning research activities are centered at the U. S. Cotton Ginning Laboratory, Stoneville, Mississippi, where experiments and tests are under way. From this center, field investigations radiate to various sections of the Cotton Belt in order to study special regional problems, make surveys of progress, and observe the practical application by the industry of the experimental findings. Long-time research activities and current new studies jointly proceed in efforts to deal with all ginning and related problems confronting cotton producers and ginners in obtaining maximum-quality cotton at minimum cost. While the Laboratory thus concerns itself with fundamental research work, it is also continuously engaged in the investigation of those practical problems which are certain to arise in our rapidly changing agricultural world.

Other activities of the Department in cotton quality and marketing improvement programs likewise produce problems of immediate concern to producers and ginners; the scope of work of the Laboratory permits ample leeway in the prosecution of its established program to include studies upon such problems and to place the resulting information in the hands of state cotton ginning specialists for dissemination to producers and ginners.

The influence of the ginning research and extension activities, now so well established in the Cotton Belt, is very encouraging; through surveys and observations, it has been found to be even more noticeable this year than last year, which was a remarkable one in cotton ginning improvement work. As a result of these and other activities, it is believed that growers are becoming fully impressed with the fact that more care on their part in harvesting and handling cotton on the farm is necessary if they expect ginners to perform superior ginning.

## Cotton Gin Surveys

During the 1939 ginning season, a preliminary study of the ginning problems, machinery and operating practices in two areas differing widely in climatic conditions, type of soil, and production methods was made by the U. S. Cotton Ginning Laboratory. This work involved gin surveys in most of the Yazoo-Mississippi Delta area and in about half of the West Texas Plains counties. The work was broadened during the 1940 ginning season to include a complete survey of representative gins in the Southeastern States, more in the Mississippi Valley States, and a representative quota of gins in the southwestern irrigated area. The gins studied in 1939 were surveyed again during the 1940 season with a view of obtaining information on the nature and extent of the changes in machinery units, condition and operating practices from one year to another.

Through the surveys in 1940, considerable data were obtained on machinery used and operating practices followed to cope with the regional problems encountered at more than 600 cotton gins located through the different regions of the Cotton Belt. The study revealed that in 1940 new saws were installed in 14 percent of the gins studied, and saws already in use in 8.5 percent of the gins were reconditioned. The saws in 8.8 percent of the gins were speeded up an average of 102 revolutions per minute. New gin breasts were installed in 2 percent of these gins and new ginning ribs in 3.5 percent of them. Also, the ginning ribs in 6 percent of the gins were reconditioned. In 5 percent of the brush gin outfits, the brushes were replaced or reconditioned. New extractor-cleaner-feeders were installed in 5 percent of the gins visited, but overhead cleaners were added in only 1 percent.

While the study showed indications of increased substitution of loose seed rolls for dense rolls in order to provide smoother ginning, one-third of the gins checked still ginned with dense seed rolls in 1940. Increased gin saw speed, improved gin saw teeth design, and better condition of gin saws, brushes, airblast systems, and ribs were factors contributing to looser seed roll operation in 1940.

## New Gin Installations

New gin installations were more extensively made in the Mississippi Valley States than in the other sections of the Cotton Belt in 1940. Almost 100 new gins were installed in this region, whereas less than half of this number were placed elsewhere. A machinery inventory made by the Laboratory of almost 100 of the new plants in the Cotton Belt showed that about two-thirds of them were equipped with facilities for conditioning and drying cotton, and almost all of them had extractor-feeders for cleaning the cotton. Over two-thirds of the new gins surveyed were equipped with the larger-sized cleaner-extractor-feeder units, while the remaining gins used the size that fits into approximately the space required for a big drum feeder. The trend in new outfits is toward more extensive cleaning and extracting facilities ahead of the gin stands. Less than 10 percent of the new gins studied in the Southeastern States were equipped with overhead cleaners, but almost one-half in the Mississippi Valley States had them, and all except one of those inspected in the West used them along with overhead extractors. Practically all of the new gins visited, or 96 percent, operated with loose seed rolls, as compared to 65 percent for the older gins studied.

Another very evident contributor to good ginning in the new plants was the high speed (600-700 revolutions per minute) at which the gin-saws were operated to provide looser seed rolls. The saw speeds averaged about 660 revolutions per minute. This was at least 125 revolutions per minute higher than the average for other representative gins surveyed in 1940. Other features of the new gins, with which better capacity, turnout and lint quality are associated, are improved designs of gin-saw teeth and roll boxes. Better regulation and more precision in control of the rate of feeding the cotton to the gin stands are also in evidence in the modern gins.

### Field Studies of Commercial Drying Operations

A three-year survey of cotton drying operations at commercial gins was completed in 1940 through the cooperation of ginners operating cotton driers in the Cotton Belt. About 250 new driers were installed during the 1940 season, bringing the total number of drier-equipped gins up to 1340. During the three-year period, 1938-1940, the driers conditioned an average of more than a million bales of cotton per year as estimated from the reports of the ginners. An average of about two-thirds of the cotton ginned by the gins reporting was conditioned prior to ginning. Forty percent of the ginnings were from green, damp, or wet cotton dried in the driers. The reports from ginners showed average ginning capacity increases of 23 percent on the moist cotton and about 4 percent on the dry cotton, as being associated with the handling of the seed cotton through the conditioning and drying units.

Based on these reports, bale value was increased an average of $4.50 with green, damp, or wet cotton and more than $1 with dry cotton as a result of conditioning and cleaning the cotton and improving its grade. The average fuel costs for all sources of heat averaged 16 cents per bale during the three-year period. With steam as a source of heat, the costs average 17 cents; with furnaces, 14 cents; and with engine waste heat recovery units, 7 cents. Since 1938, the trend in new installations of heating units has been toward gas-fired furnaces, with about 50 percent of the operators of new drier installations reporting their use in 1940, as compared to a three-year average of 25 percent.

### Adoption of System for Handling Pure Seed

As a result of the increased interest in cotton improvement and preservation of the purity of seed at cotton gins, more than one-third of the new gins are equipped with self-cleaning pure seed handling devices - either the vacuum blow method or the belt system in lieu of conveyors under the gin. In some areas, these improved methods of handling seed from the gins have been installed in existing gins in place of the conveyors. Surveys have shown that only a small percentage of the active gins are now using them and that an extensive improvement in gins may be expected in this respect.

### Laboratory Developmental Work

Along with the field investigations heretofore discussed, the annual program of experimental and developmental work was carried out in the Laboratory at Stoneville. Many units of ginning machinery and different kinds of operating practices were subjected to laboratory-tests, including new gin stands operated at various speeds and with different seed roll densities, old versus modernized gins under several conditions of operations, gin stands with various sizes of roll boxes, cotton drying units under varying conditions, humidification devices for conditioning lint ginned by both airblast and brush ginning, roller gin equipment, and new units and combinations of cleaning and extracting machinery. Studies of harvesting and handling methods and seed cotton characteristics in relation to ginning were continued. Concurrently with these experiments, a new gin press for pressing a 500-pound bale to standard density of 22-25 pounds per cubic foot was subjected to extensive tests.

## Gin Operating and Design Studies

The studies of variations in gin saw speed and seed roll density provided data which indicated that the speeds being employed by the manufacturers on the new gins are optimum so far as ginning quality and efficiency are concerned. With loose seed rolls, the tests showed that more than a bale per hour per stand could be ginned and that ginning preparation was generally smooth when the cotton was in suitable condition for ginning and when the cotton came to the gin dry or was dried enough through driers to permit smooth ginning.

The modernized gin, having new saws, operating at 600 revolutions per minute, and a new brush and cleaner-extractor-feeder properly operated, gave better capacity, turnout and quality than the twin gin of the same design which was not rebuilt and which employed a plain drum feeder and was operated with saws in poor condition at 400 revolutions per minute and with a brush that had not been reconditioned. Modernization decreased ginning time 30 percent and increased bale weight 20 pounds. When the two gins were operated at the same capacity, the seed roll of the unmodernized gin tightened up and caused rougher ginning preparation than that associated with corresponding ginnings made on the modernized gin.

A three year study of roll box design was completed this year; in general, the results showed that by reducing the size of the roll box on the representative gin tested, significant increases in ginning capacity could be attained with no loss in lint quality, and very little decrease in lint turnout.

## Cotton Drying Experiments

In 1939 unconfirmed reports from several ginners came to the Laboratory to the effect that the process of artificially drying seed cotton at gins presented serious problems in seed storage at oil mills and caused undesirable increases in the free fatty acid content of the seed. Studies designed to duplicate the conditions of oil mill storage were made in 1939 in an effort to obtain data under controlled conditions to refute or confirm these reports.

The storage tests conducted on cotton seed ginned from lots of undried damp or wet seed cotton and lots of the same seed cotton artificially dried at temperature 160°F., 190°F., and 220°F., indicated that the process of drying before ginning did not cause an increase in the deterioration of the seed in storage; in fact, the seed ginned from the dried cotton did not show as much deterioration in storage as did those ginned from the undried cotton. It is of further interest to note that the higher the drying temperature used, or the greater the moisture removal from the seed, the less was the increase in free fatty acid content of the seed at the end of ninety days' storage of the lots of seed in large metal containers. Similar studies made in 1940 confirmed the findings of the first year's work. Also during both years, the seed ginned from the cotton picked and ginned in a dry condition did not change in storage with respect to free fatty acid content, and the process of artificially drying the seed cotton had no influence on this property of the seed.

In a commercial gin, two years of cooperative field trials of an inexpensive cast iron oil-burning furnace as a source of heat for a small tower drier were completed. The practical operating tests confirmed Laboratory findings in connection with tests of this method of providing heat for driers handling small volumes of air. It was possible to maintain a temperature of 125° - 135° F. with an air volume of 3600 cubic feet per minute and obtain fairly satisfactory moisture removal with the average run of cottons with a fuel cost of 5 cents per bale.

Field observations on methods of utilizing exhaust and cooling water from Diesel engines, developed by the Laboratory as an economical source of heat for drying, were made again this year; assurance was had that this source of heat continues to be practical and is highly desirable.

## Certain Seed Cotton Characteristics Affecting Ginning

In a three-year study of the ginning behavior of different varieties of cottons grown under similar conditions, it was again found that several of the varieties ginned 20 to 25 per cent slower than some of the others. The data substantiate findings of previous years in this respect and indicate that the fuzzier and the larger the seed, the greater is the time required for ginning lint of comparable quality. Energy consumption in ginning has also been found to vary with ginning time for different varieties. Furthermore, the longer varieties with average seed fuzziness, in general, require more time to be ginned properly than the shorter-staple varieties.

## New Development in Unloading Fans

A recent development by the U. S. Cotton Ginning Laboratory in unloading fans is a cone-shaped Rembert fan which is proving to be more efficient than the flat-disc type.1/ It was described in the March issue of the Cotton Ginners' Journal. 2/ Several of these fans have been subjected to field trials in the Mississippi Delta during the past two years, and observations completed on their performance this year confirm the results obtained with them in Laboratory tests.

---

1/ Franks, Gerald N., U. S. Patent No. 2,225,397, Cotton Fan, issued December 17, 1940.

2/ Bennett, Charles A. and Gerdes, Francis L. Unloading Fan Improvements for Improving Efficiency. The Texas Cotton Ginners' Journal, March. 1941.

## Laboratory and Field Investigations in Roller Ginning

In the field of roller ginning, the Laboratory conducted a number of Laboratory tests, and launched some field investigations as a result of increased interest in the production of Sea Island and American-Egyptian cottons. Among other things, previous findings in connection with the cleaning of these cottons were confirmed, namely: that trashy Sea Island cotton cannot be mechanically cleaned successfully without "nepping" the fibers; and that American-Egyptian cotton gives better response to cleaning than Sea Island, being fairly well cleaned by passage through an extractor-cleaner-feeder.

Also, the Laboratory's contention that increased ginning capacity can be obtained and maintained successfully on roller gins by using balanced eccentrics in place of cranks for driving the moving knife of the gin at higher than conventional speed was confirmed in field trials this year. Laboratory results had indicated that ginning capacity increased in direct proportion to the increase in the speed of the mechanism driving the moving knife, for example, almost 40 per cent by increasing the crank speed 40 percent (from 645 to 900 revolutions per minute). Confirmatory data are now available which prove that reasonable increases in roller speed, over the conventional speed range, and mechanical vibration or agitation of the seed grid also are factors contributing to increased ginning capacity; but each of these is of far less importance than the increase made in the speed of the mechanism driving the moving knife of the roller gin.

Static electricity and other factors have prevented the ginners in the irrigated sections from adopting the lint doffer developed by the Laboratory for improving the efficiency of roller-ginning and the smoothness of the lint. The Laboratory is studying this and other problems in the West with a view of overcoming the obstacles to the use of a doffer such as is being adopted in Sea Island cotton ginning in Georgia and Florida where static is seldom found. Devices are needed for placing a small amount of moisture on the cotton side of the gin roller, just enough to dampen the surface without wetting the covering. Furthermore, before the doffer is adopted in the irrigated regions, most of the existing gins would have to be raised from the floor enough to provide room for the ginned lint to remain under the gin until a sufficient amount is ginned to make one charge for the press.

Since the walrus hide for roller covering is prohibitive in price and difficult to obtain, operators of roller gins are turning to rubber packing as a substitute. Various kinds of packing and methods of attaching the packing to the core of the rollers have been tried out at the Laboratory. The tests indicate that the more promising packing coverings will last longer than walrus and cost about half as much. One of the latest developments of the U. S. Cotton Ginning Laboratory in packing-covered rollers is designated as a "semi-self-grooving-roller". 3/ This roller is constructed with a strip of 3/16 to 1/4 inch leather belt between every two strips of packing; since the leather is softer than the packing, it will wear faster and stay just below the surface, thereby serving as a groove to clear the knife of abortive seeds and motes or other foreign

---

3/ This method of roller covering was developed by James S. Townsend, Technologist, Bureau of Plant Industry, with the assistance of Staff members of the U. S. Cotton Ginning Laboratory.

matter which may be in the seed cotton.

## Studies of Bale Packaging

The Laboratory is now equipped with several types of experimental cotton-bale presses, among which is a new 500-lb. Standard Density gin press. The construction of this experimental press was purposely heavier and stronger than that of a commercial gin press for such service would be. It is all-steel and weighs approximately 48,000 pounds, having a large factor of safety in its sills because of the necessary strength required to withstand experimental pressures. The press box is of conventional depth and cross-section, namely, 114" x 27" x 54", has current types of condenser and tramper, and is capable of making the 500-pound bale of present day marketing practices. The press is hydraulically operated, having three 9½" diameter rams which require pressures of from 3,000 to 4,000 pounds per square inch when pressing out 500-lb. bales to 24 lbs. density. Top and bottom platens are all-steel and so grooved as to permit the use of as many as 11 wire or flat cotton ties. It requires a high pressure pump, capable of delivering from 3 to 16 gallons of oil per minute, and at present takes a peak load of about 35 horsepower to press out a bale within 3 minutes. However, recent tests indicate that by lengthening the pressing time this can be reduced so that the power requirements will range from 20 to 25 horsepower. The present gin-press pumps are not suitable for use with this press because they are unable to deliver the required pressures and are not arranged for special valving.

An interesting feature of this press is its unique piping arrangement. In the initial pressing stages when pressure requirements are low, the oil is delivered to only the center ram which lifts the outside rams. Oil flows by gravity to the two outside casings as those rams are raised. When the power load reaches a certain point, oil is then turned into the two outside rams slowing up the rate of travel and thus making it possible to obtain the additional force necessary for pressing a bale of cotton to the standard density of 24 lbs. per cubic foot.

To stay within reasonable power limits, the time requirements for pressing such a bale are somewhat greater than for the usual flat bale. However, bales can be pressed and tied out in ample time to permit use of this press in a 5/80 gin outfit.

The studies of bale cutting, inaugurated in 1939, were for the most part completed recently and the findings were reported along with other research information collected in connection with studies of cotton compression.[4] The results from these investigations do not support the theories that cutting is due to air compressed within the bales, excessive speed of compression and certain kinds of bale coverings. The actual cause of cutting appears to be uneven packing of bales at gins, a condition which is accentuated in some cases by excessive weight of bales, excessive dryness of cotton and a high proportion of thin-walled fibers in the cotton. There is considerable variation between cotton from different gins in the proportion of bales cut. Likewise, there are variations in the extent of cutting at different compresses. Apparently the elimination of cutting during compression will involve modification of gin-packing equipment and compress equipment and require discontinuance of the packing of extra-heavy bales. Although the effect of bale cutting on the spinning value of the cotton is not very important, damage to the bale package, the extra time required to handle cut bales at the compress, and more particularly the adverse reaction of spinners to such bales justify an effort to eliminate bale cutting.

---

[4] The Compression of Cotton and Related Problems by John W. Wright and Charles A. Bennett. Multilithed November 1940.

The studies also showed that improvements in the packing of bales at gins so as to eliminate bales of irregular shape and excessive weight would facilitate the compression of the bales. A greater degree of standardization of bale weights not only facilitates all services incident to the handling and the marketing of cotton, but contributes to the improvement of the American bale package and the reduction of marketing and handling costs.

## Field Application of Research Findings

Thirteen cotton producing states are now participating in the Federal-State extension ginning improvement program. Much of value has resulted from the efforts of those who started their work several years ago; their experiences, in conjunction with those of the Ginning Laboratory are very opportune and are being put into use by all states now joining in the work. The three-stage procedure used in the ginning research-extension program, in the order named: (1) Laboratory ginning developments, (2) trial proving tests under actual ginning operating conditions; and (3) final extension to applications at gins, has proved and is continuing to prove to be worthwhile to the cotton industry with minimum costs and maximum benefits.